

Reach for the Stars – Answer Key

Team #: _____

Team Name: _____

- Please write you team name and number on your answer sheet.
- 12 stations – 3.5 min per station
- Review time at last station (remaining min)
- Answers must be legible. 1 point for each correct answer (109 points total)

Station 1	8 Points
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1. New General Catalogue
2. A. parsec
B. Parallax of one arcsecond
3. A. 1 AU is roughly the distance from Earth to the Sun.
B. 8 minutes (or 8.31675 minutes)
4. 149,597,870,700 m (about 150 M km, or 93 M miles)
5. 63241.1 AU
6. 1990 – 51 (Castor is 51 light years away) = 1939

Station 2 - Identify Constellation Set 1	4 Points
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7. Cassiopeia
8. A: Cygnus
B: Almost exactly overhead
C: Milky Way Galaxy

Station 2 - Identify Constellation Set 2	2 Points
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9. Dorado
10. Tucana

Station 2 - Identify Constellation Set 3	2 Points
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11. Serpens
12. Sagittarius

Station 3 - Identify Star - Set 1	4 Points
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13. A: Arcturus
B: Alpha Boötis (α Boötis, abbreviated Alpha Boo, α Boo)
14. A: Procyon
B: Alpha Canis Minoris (α Canis Minoris, abbreviated Alpha CMi, α CMi) or Little Dog Star

Station 3 - Identify Star - Set 2**4 Points**

15. A: Deneb
B: Alpha Cygni (α Cygni, abbreviated Alpha Cyg, α Cyg),
16. A: Pollux
B: Beta Geminorum (β Geminorum, abbreviated Beta Gem, β Gem)

Station 3 - Identify Star - Set 3**2 Points**

17. Regulus or Alpha Leonis (α Leonis, abbreviated Alpha Leo, α Leo)
18. Alcor or Mizar

Station 4 – Deep Sky Objects - Set 1**6 Points**

19. NGC 7293 or Helix Nebula
20. Optical or Visible
21. Infrared
22. M57 or Ring Nebula
23. Red Giant
24. White dwarf

Station 5 – Deep Sky Objects - Set 1**4 Points**

25. NGC 3603
26. Carina
27. No – This DSO is visible in southern hemisphere
28. Hydrogen (or H or HII – accept these answers too)

Station 5 – Deep Sky Objects - Set 2**4 Points**

29. Cassiopeia A (or Cas A) SNR (Source – Smithsonian 3D model)
30. M or W.
31. FeK (Chandra Telescope) - The green portions of this model represent radiation from the element iron as seen in X-ray light from Chandra. Iron is forged in the very core of the star but ends up on the outside of the expanding ring of debris.
32. Fiducial Jets - In purple, two jets of material are seen. These jets funnel material and energy during and after the explosion. They mostly contain Silicon.

Station 5 – Deep Sky Objects - Set 3**3 Points**

33. 30 Dorado or Tarantula Nebula
34. Large Magellanic Cloud (LMC)
35. Either answer acceptable - Star cluster NGC 2070 (or Caldwell 103)) which includes the compact concentration of stars known as R136 (or RMC 136).

Station 6 – Star Classification**15 Points**

36. T – White dwarfs which remain after supernova
37. Q, R, S – Main sequence stars (mark incorrect if other letters are mentioned)
38. P
39. P
40. b
41. T
42. S
43. a
44. A – Red Dwarfs
B – Super Red Giant
C- Red Giants
D- Main Sequence
E – White Dwarf
45. Lines of constant radius - Radius of the stars as compared to Sun's radius
46. They all have very similar radius (size is not an answer, since size can be radius or mass or density)

Station 7 – Astronomical Spectroscopy**8 Points**

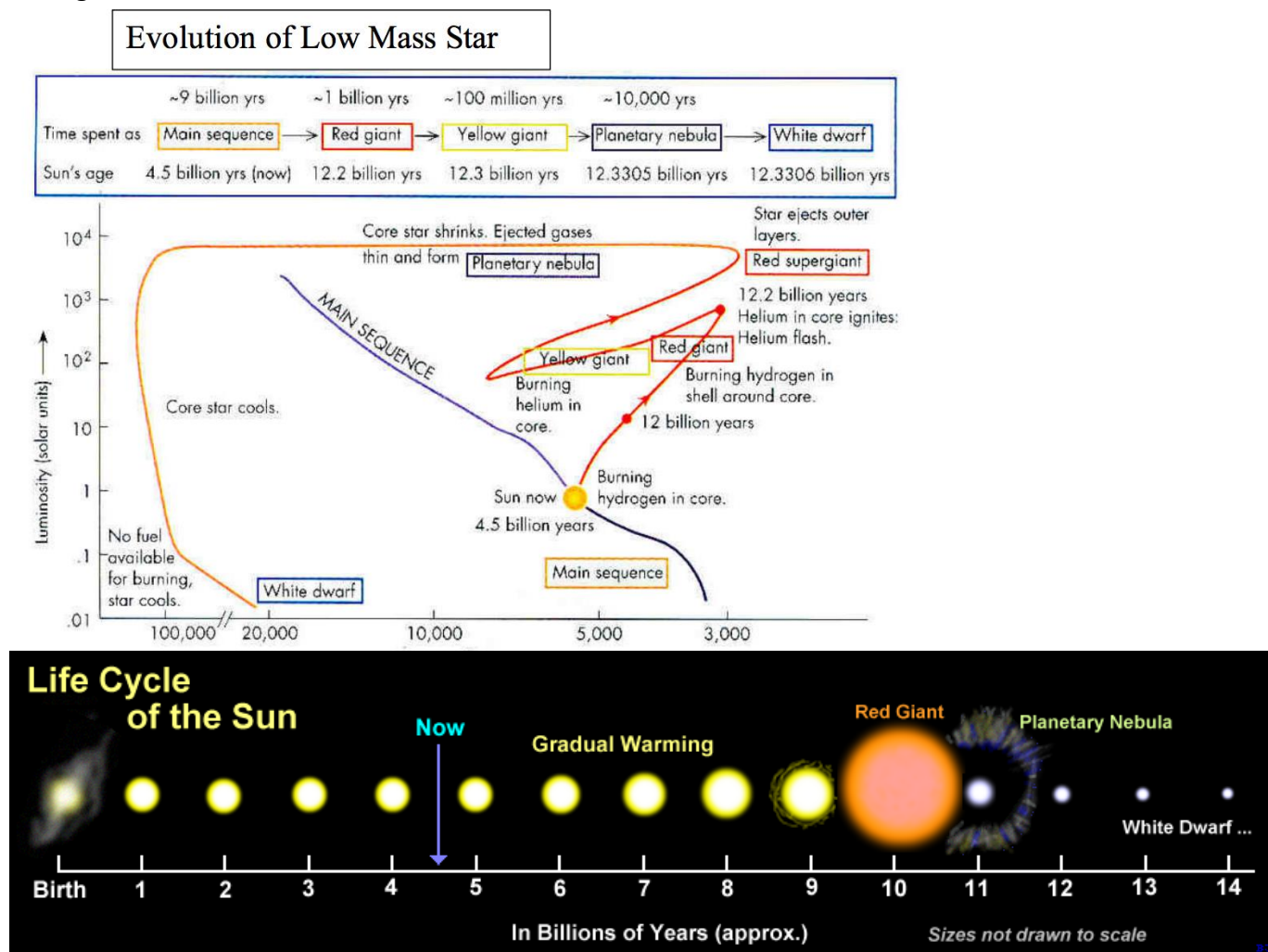
47. M16 or Eagle Nebula
48.
 - A. Composite of Optical/Visible and X-Ray
 - B. Infrared
 - C. Optical / Visible
 - D. For i, ii, iii - Any 3 out of
chemical composition, temperature, density, mass, distance, luminosity, size in terms of radius, levels and
types of radiation, and relative motion using Doppler shift measurements
49. EGG - Evaporating gaseous globules

Station 8 – Stellar Evolution 1**10 Points**

50. Protostar (description of what was needed to be answered was given in the picture)
51. Main Sequence
52. Super Giant (Red supergiant is ok)
53. Red Giant
54. Planetary Nebula
55. White Dwarf
56. Black Dwarf
57. Supernova
58. Neutron Star
59. Black Hole

Station 9 – Stellar Evolution 2**11 Points**

60. See figure below



1 point – for diagram

Star phase	Points	Time spent	Points
Main sequence	1	9 billion years	1
Red Giant	1	1 billion years	1
Yellow giant to Red supergiant	1	100 million years	1
Planetary Nebula	1	10,000 years	1
White dwarf	1	Unknown	1

Station 10 – General Questions 1**7 Points**

61. Absolute Magnitude - “true brightness” – brightness as seen from 10 parsecs (32.6 light years)
 62. Apparent Magnitude - the brightness of object as seen from the viewer’s viewpoint (Earth)
 63. Absolute Bolometric Magnitude - Brightness at ALL wavelengths (from 10 pc).
 64. distance modulus
 65. A: Watts
 B: Watts / m²
 66. The Sun appears brighter than Sirius (Doh!).

Station 11 – General Questions 2**8 Points**

67. A: Absolute
 B: Apparent
 68. A: Distance 62.5 pc or 203.85 Light years
 B: Absolute Magnitude or $M_v = 2$

$$d = 1/p = 1/0.016'' = 62.5 \text{ pc}$$

If $d = 63 \text{ pc}$ then the Distance Moduli table tells us $m_v - M_v = 4$.

Recall $m_v = 6$, so $6 - M_v = 4$
 $M_v = 2$

$m_v - M_v$	$d \text{ (pc)}$
0	10
1	16
2	25
3	40
4	63
5	100
6	160
7	250
8	400
9	630
10	1000
11	1600
12	2500

69. Binary stars / binary system
 70. Q1: A
 Q2: C
 Q3: C

Station 12 – General Questions 3**7 Points**

71. Chandrasekhar limit
 72. Type 1 A
 73. A Brown Dwarf
 74. By studying its orbit around a binary companion
 75. Star B is closer to earth than Star A.
 76. Nuclear Fusion
 77. It doesn’t – White dwarfs DO NOT produce energy